NASA Health Physics Conference

MAF ALARA Program
X-Ray NDE

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- Three Types of X-Ray NDE Testing at the Michoud Assembly Facility
  - Film
  - Digital
  - Backscatter

- ALARA Program
  - Certify the exposure levels at the barriers are less than 2 mR/hr
  - All personnel performing radiography radiographic operations shall wear an alarming rate meter (500 mR/hr), a pocket dosimeter and a TLD badge.
  - Pocket dosimeter reading will be recorded at the beginning of each radiography operation and at the end of each work shift.
  - If the pocket dosimeter indicator goes off scale or records a dose at or above 200 millirems during a work operation, the wearer will notify supervision immediately.

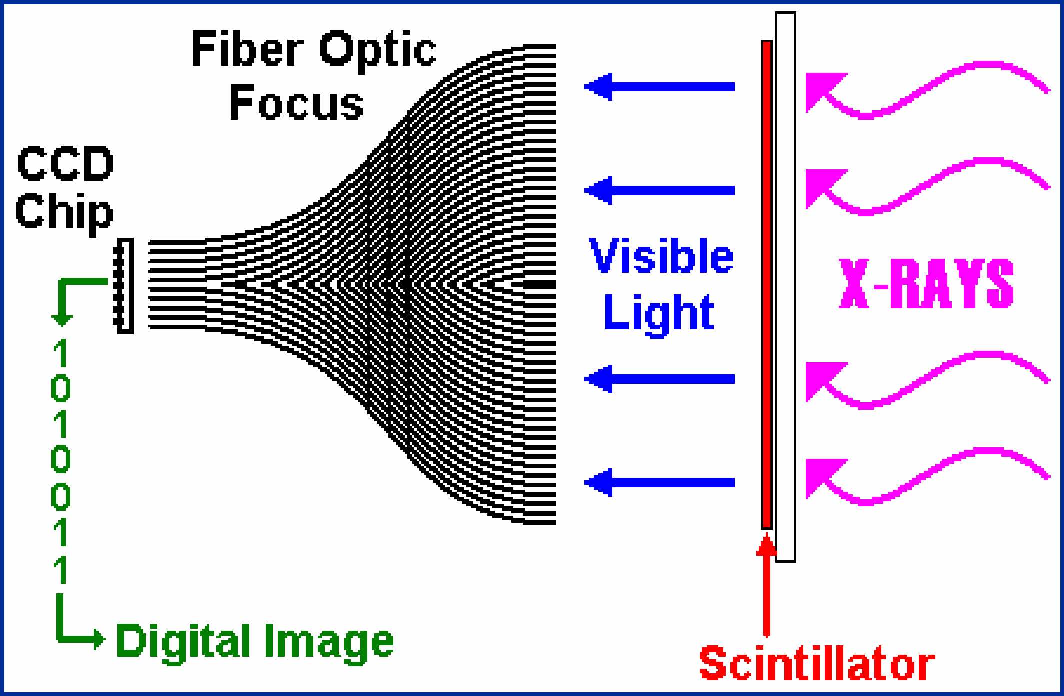
Digital X-ray

Traditional Film X-ray Method

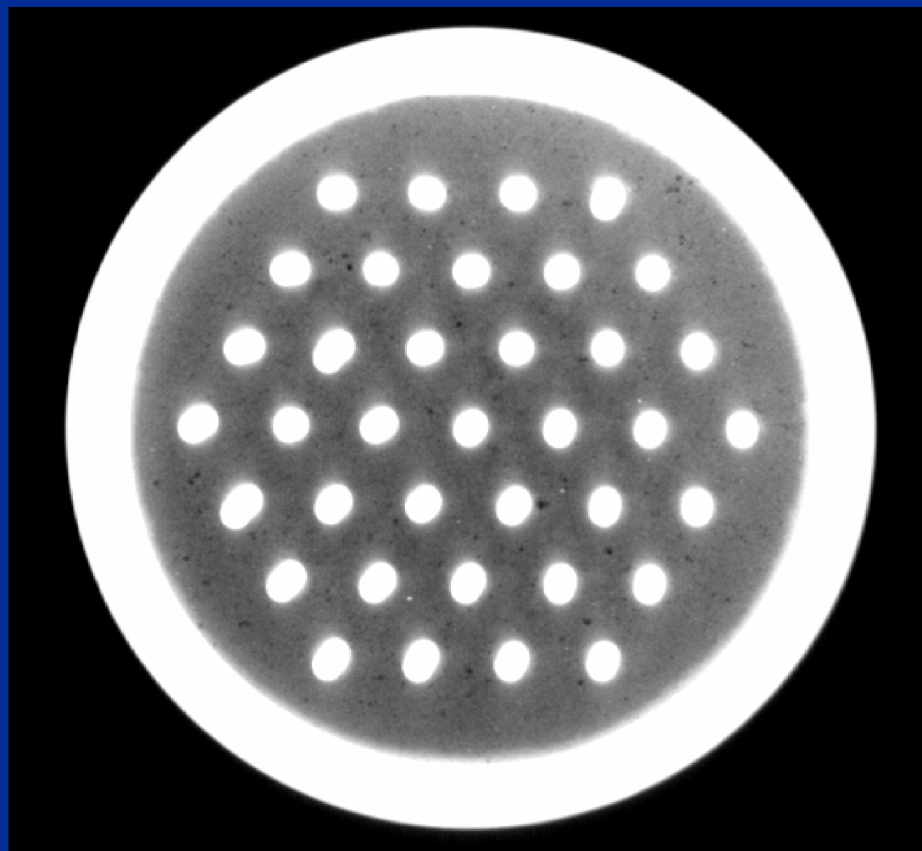
- **Uses sheet film, chemicals and developer to produce a viewable image.**

Digital X-ray Method

- **Uses a scintillator plate to convert x-rays to visible light which is focused onto a Charged Couple Device (CCD) that outputs a digital image.**



ET-125 Digital Radiographic NDE Assessment



Air voids throughout image inherent to part

81L2-2 Feedthrough Standard

Lot No. 9934A

Digital X-ray

Benefits:

Increased Safety/Reliability :

- **Digital radiography eliminates safety or environmental concerns from hazardous chemicals used to develop film**
- **Digital storage prevents loss of irreplaceable films**

Cost Reduction :

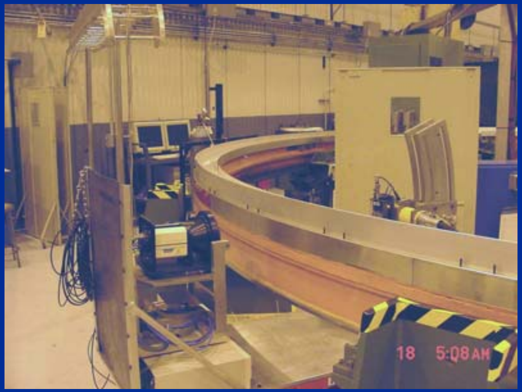
- **Digital radiography eliminates the expense of film and developer**
- **Image is available for interpretation in less time**
- **Process lends itself to automation for overall NDE time reduction**

Conclusion:

Digital radiography saves time and money while providing a safer and more reliable product.

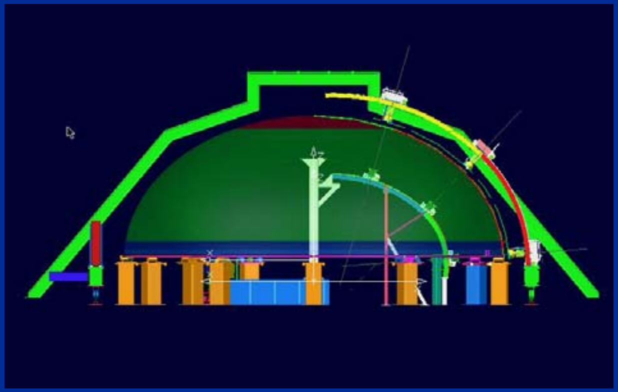
Digital X-ray

5017 T-ring Tooling



Status: Installed on tool

5354 Dome Tooling



Status: In fabrication

Backscatter - ET-121 TPS NDE

BSX Head on Scanner

Scanning Table Configured for
ET Inspection

TPS NDE Background

At the time of the Columbia accident, there were no Thermal Protection System (TPS) Non-Destructive Evaluation (NDE) methods available for Spray-On Foam Insulation (SOFI) and pour foam inspection. Development efforts in this area had been pursued at the Michoud Assembly Facility (MAF) and other National Aeronautics and Space Administration (NASA) centers from the early 1980s to the early 1990s, but with no success. As a practical matter, inspection of low-density plastic type materials does not represent a large part of the NDE market. These materials are inexpensive and generally considered disposable. If a builder spraying insulating foam similar to that used on the External Tank (ET) experiences a problem with the spray, he simply strips off the suspect material and discards it. Small voids or other defects are not a major concern, because the material is not used for any structural purpose. The nature of TPS materials and how they are used on the ET program has required development of non-traditional NDE methods to solve this inspection problem.

Backscatter Radiography Background

• Backscatter Radiography is an inspection method that involves exposing a part to x-rays and collecting the x-rays that are ‘scattered’ back from the part.

• The collected x-rays are actually secondary x-rays generated by interaction between the incident x-ray beam and the material that it passes through. This is Compton Scattering, in which the incident x-rays are absorbed by the atoms in the part and then re-emitted as lower energy x-rays.

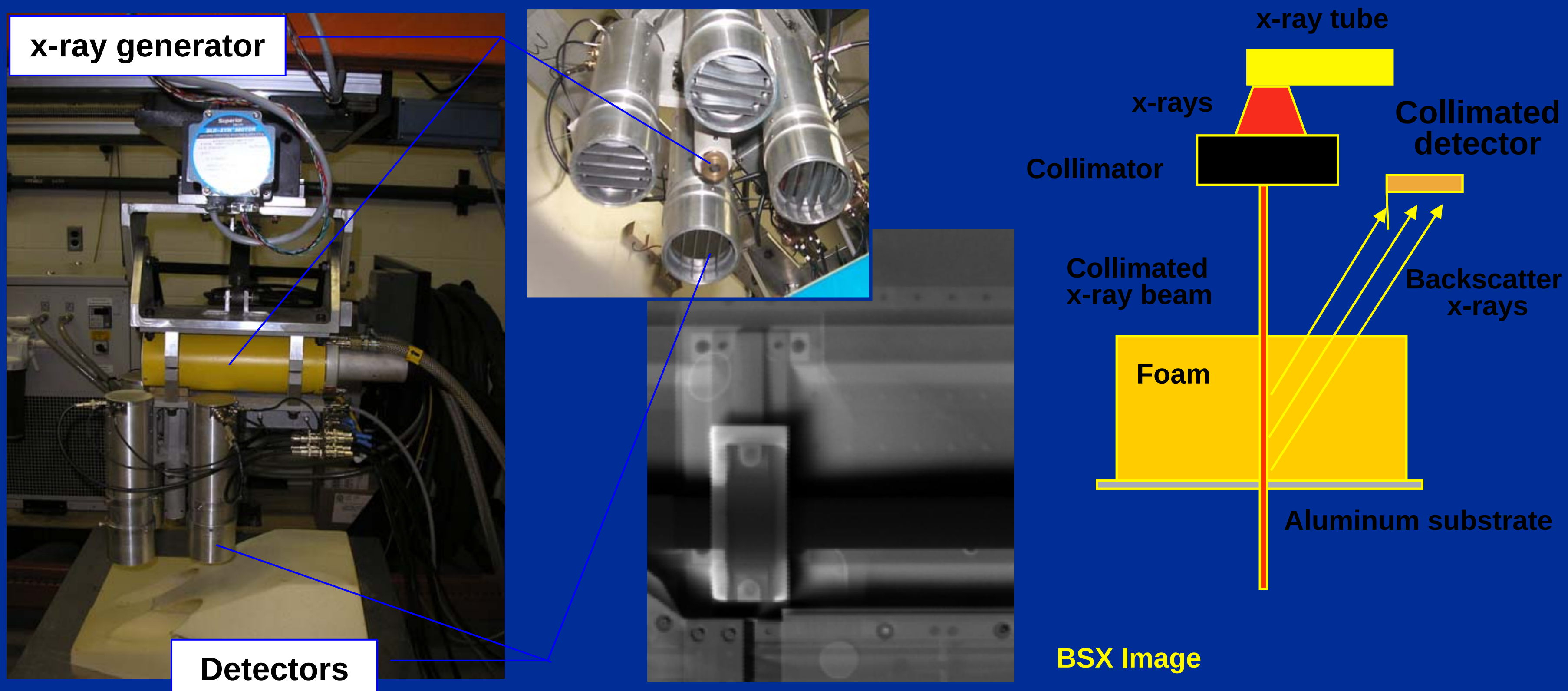
• Backscatter Radiography provides similar contrast images to transmission radiography but only requires access to one side of the part. This characteristic and the ability to penetrate the relatively low-density foam material make Backscatter Radiography an effective inspection method for TPS NDE

•A standard industrial x-ray tube is used to generate x-rays that are then collimated into a narrow beam. The MAF system has an adjustable beam diameter, which is typically set to 0.1 inch. As the collimated beam passes through the foam it produces backscatter x-rays that strike the detector. Differences in backscatter x-ray density are produced when the beam travels over a void or other defect.

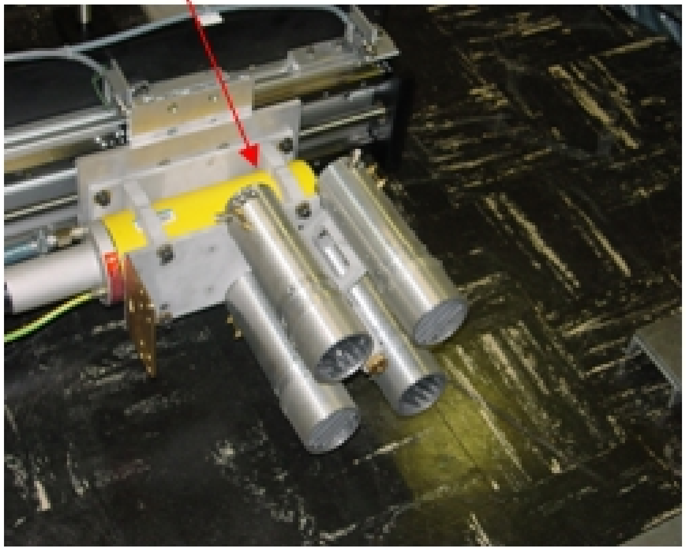
• The system is mounted on an x-y scanner that can cover a 2-foot by 2-foot area.

BACKSCATTER RADIOGRAPHY

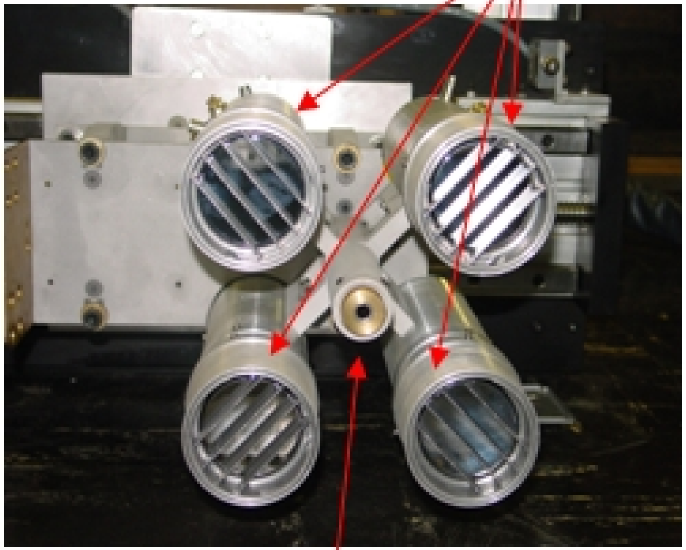
- Collimated beam of x-rays interact with sample molecules
- Backscatter x-rays are emitted (Compton Scattering), possibly after multiple subsequent scattering events, and detected by collimated detectors
- The collimated detectors provide some preferential sensitivity to selected depth
- The x-ray beam and detectors are scanned across the part to generate a 2-D presentation of the internal make-up of the foam. 1 sq foot per hour



Backscatter instrument



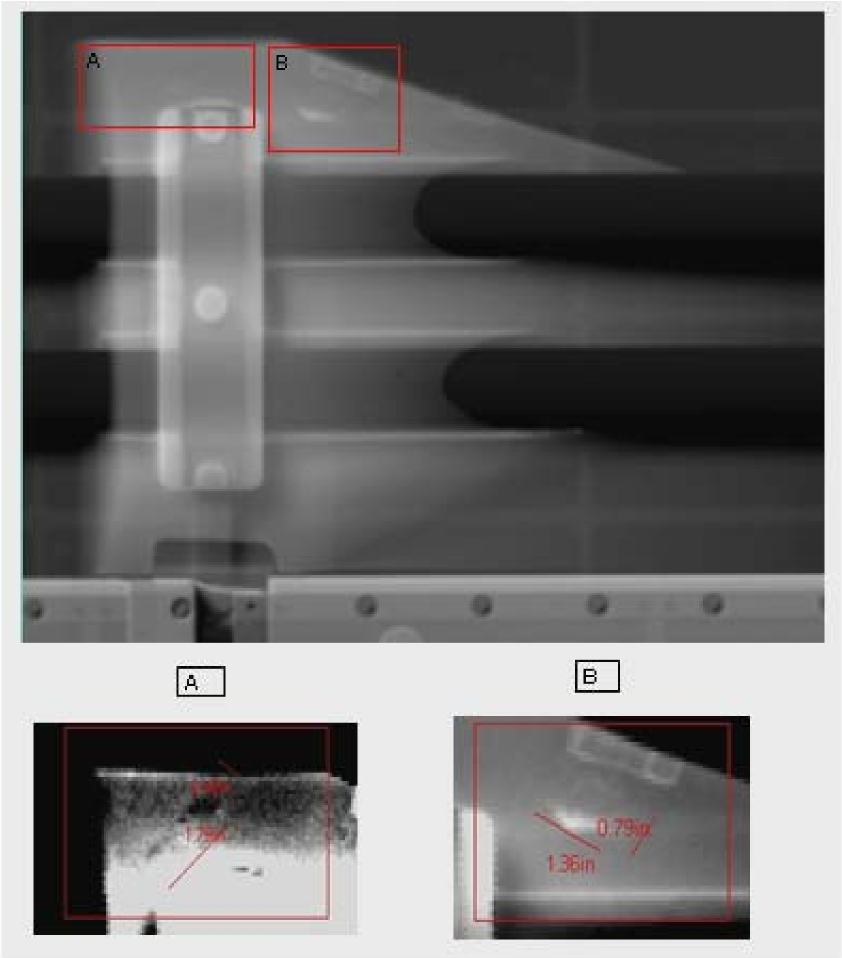
Detectors with collimators



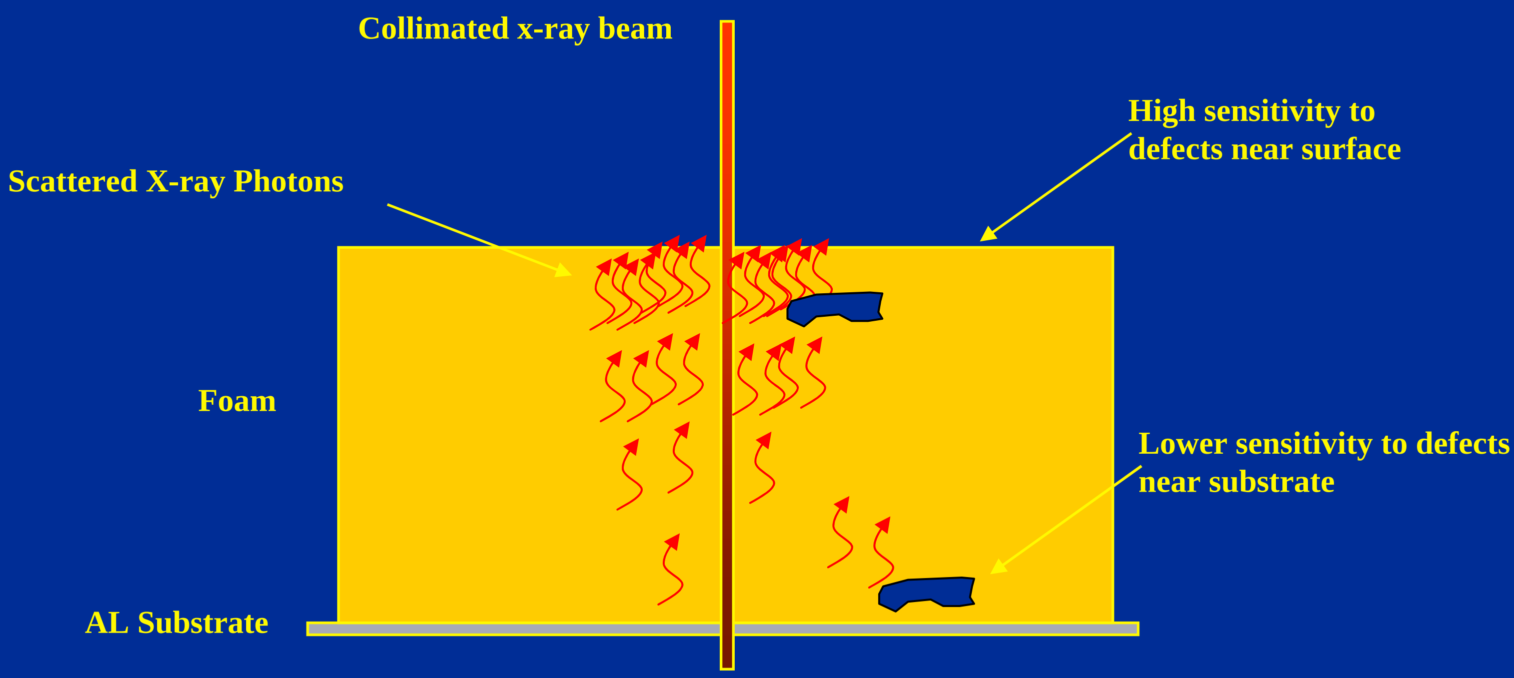
Beam collimator

ET123 IFR Indications

- ***Station 1657***
  - *Linear indication*
  - (A) 1.79"X, .48"Y
  - *Area More Dense*
  - (B) 1.36"X, .79"Y



- Backscatter theory of operation
  - Typical x-ray energy for foam is 55 kV
  - Foam attenuates incident x-rays so intensity drops with depth
  - Scattered photons are scattered or absorbed by the foam so those that originated deeper are less likely to reach the detector



Michoud Assembly Facility

MAF Transition

MAF Transition
NASA Direction and Intent

- NASA has made a strategic decision to transform MAF into a NASA facility that supports multiple programs
- To implement this NASA decision, MSFC created the MAF Transition Office to plan and manage the transformation, and define and implement a new business model
- Retain the MAF incumbent workforce to the maximum extent possible:
  - Experienced employees
  - Familiarity with MAF
  - Familiarity with NASA/MSFC policy and procedures

NASA Michoud Long Term Commitment

NASA Administrator Michael Griffin

"We are counting on you to continue providing the shuttle external tanks that will enable us to complete the space station and prepare for the next great era of space exploration. And we will rely on you to be at the forefront of this epic era, producing the tanks that will enable our Crew Exploration Vehicles and Heavy Lift Launch Vehicles to send our astronauts to the Moon, Mars and beyond." *January 2006*

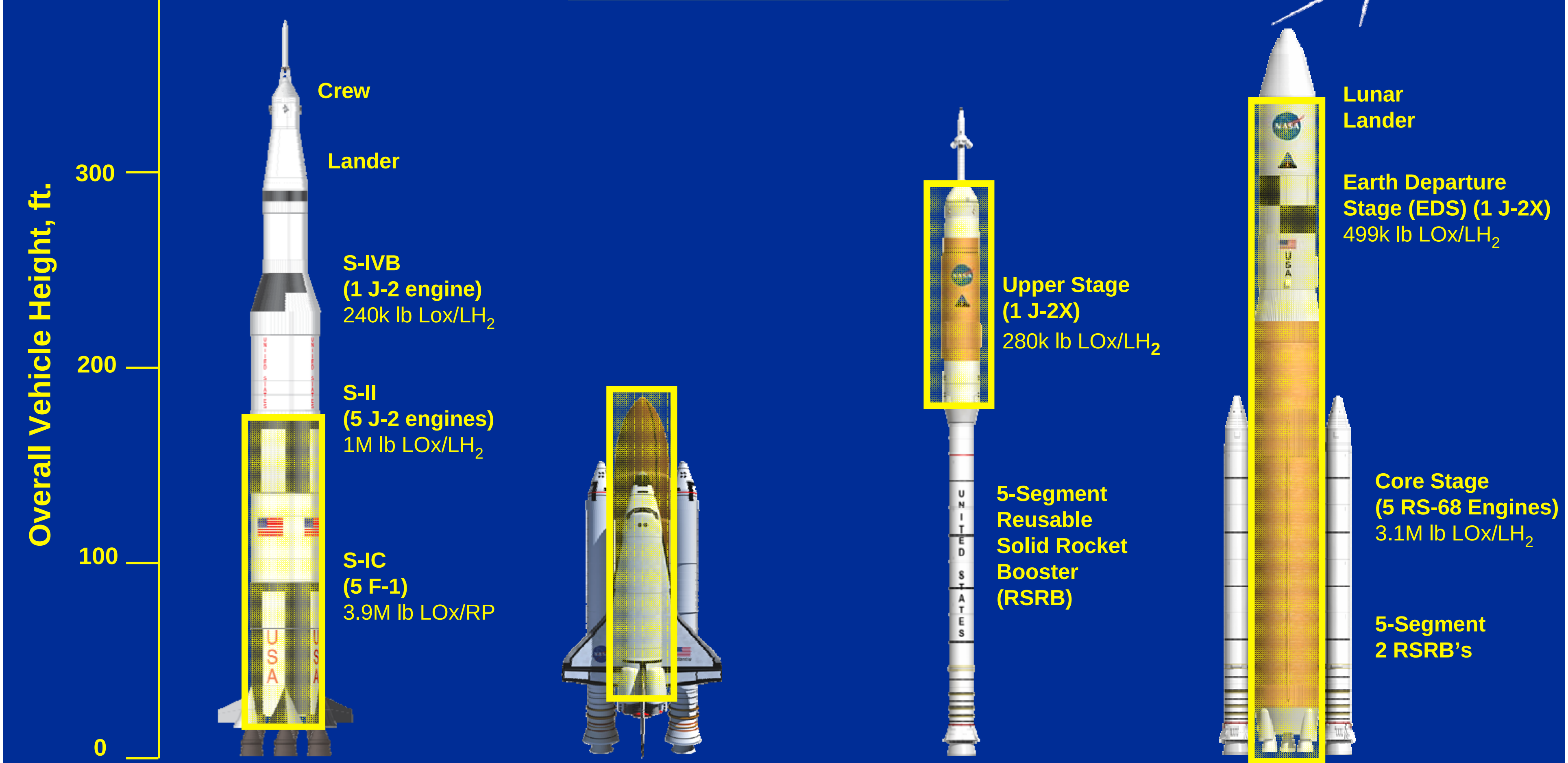
NASA Constellation Management

"This is going to be the largest rocket in history……We are going to fill up that plant down at Michoud to manufacture it…"
April 2007, Constellation Program Manager, Mr. Jeff Hanley

http://www.nasa.gov/mission_pages/constellation/main/index.html

Yesterday, Today, and Tomorrow

Elements at Michoud



Saturn V
Height: 364 ft
Gross Liftoff Mass:
6.5M lb

Space Shuttle
Height: 184.2 ft
Gross Liftoff Mass:
4.5M lb

Ares I
Height: 321 ft
Gross Liftoff Mass:
2.0M lb

Ares V
Height: 358 ft
Gross Liftoff Mass:
7.3M lb

MAF- Orion Capsule -Lockheed Martin

MAF – Upper Stage - Boeing

- NASA’s Michoud Assembly Facility in New Orleans, will manufacture the Orion capsule manufacture and assemble the Ares I upper stage

NASA/Marshall Space Flight Center (MSFC)
Michoud Assembly Facility (MAF)


NASA
Michoud Assembly Facility
Investment in the Future
• Advanced World-Calss Manufacturing Facilities
• Attract Private Sector Research, Design and Manufacturing
• Collaborative Partnership with State of Louisiana, Private Industry, and Academia
• Highly Skilled Workforce
• Provide Future Growth Opportunities for the Region
• Enhance and Reinforce NASA Core Mission Objectives
• Permanent U.S. Coast Guard Installation
Future Fire Station
Main Security
New Service Station
Gate 5
Gate 7
Gate 11
Gate 12
USCG Dock Facilities
USCG / NASA Dock
Phase 1 Development
Phase 2 Development
Phase 3 Development
Future Recreation
NASA
Supplemental Pump Station
Facility Enhancements
• New NASA / MAF Administrative Headquarters
• New Advanced Technology Research Park
• Improved / Expanded Employee Recreation Amenities
• New Fire Station Serving MAF and Surrounding Community
• Improved Facility Security Infrastructure
• Improved Pumping Station to Enhance Flood Control
• Phased Future Private Sector Development Areas
New Gate 5 Complex
• Main Security Gate
• Fire Station Serving MAF and Local Community
• Service Station and Store
• Outdoor Employee Recreation Area
• Walking Track and Pavilion
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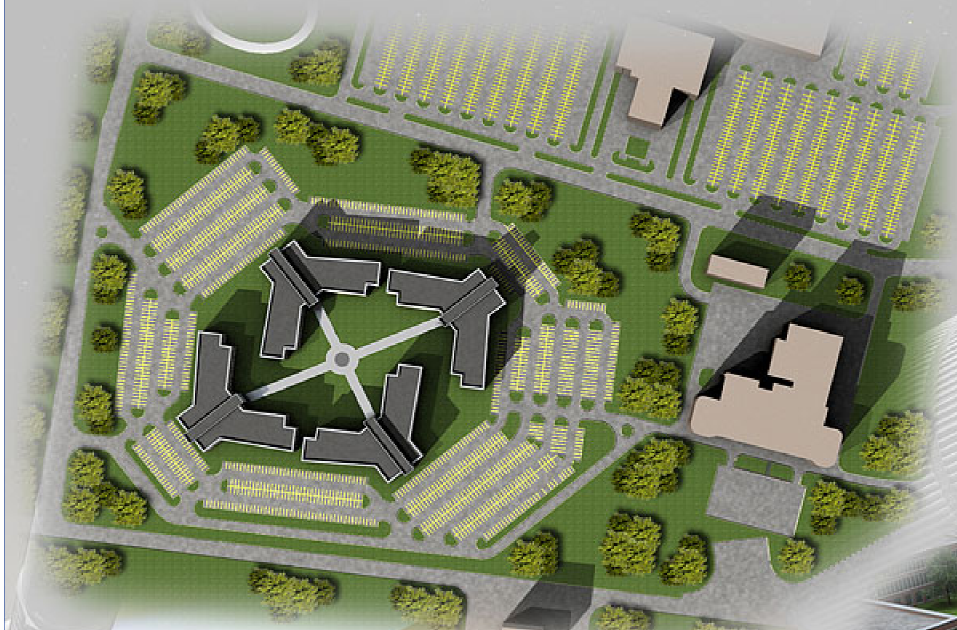
Creating a better life by design.
BWSC

NASA
Michoud Assembly Facility



New Advanced Technology Research Park

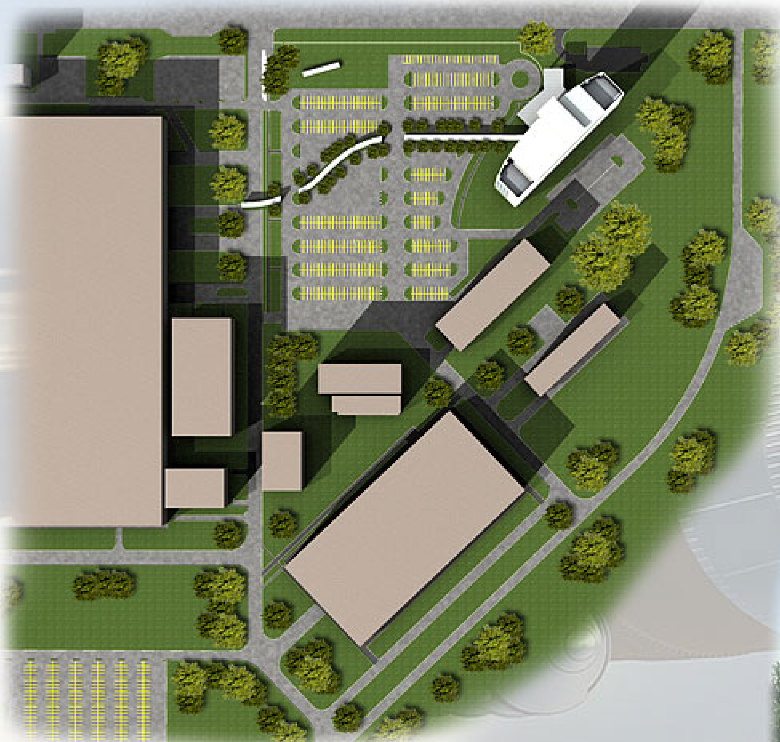
- Utilization of Underutilized Green Space
- 168,000 sq.ft. Total Floor Area
- Four 42,000 sq.ft., 3-Story Buildings
- Campus-type Setting
- Enhanced Use Lease Facilities to Attract Private Sector Companies
- Potential Location for both Industry and Academia

paradigm

Creating a better life by design.

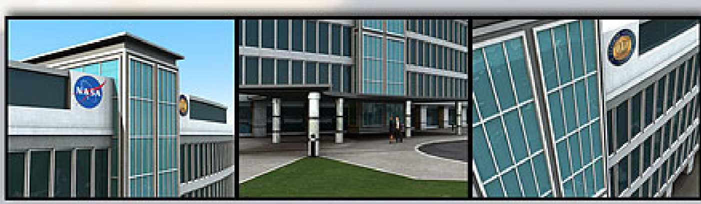
BWSC Barge Waggoner Sumner & Cannon, Inc.

NASA
Michoud Assembly Facility



New Administrative Headquarters

- 160,000 sq.ft., 5 stories
- Top-Level Conference and Training Center
- NASA Resident Offices
- NCAM Offices and Conference Areas
- New Space Flight Hardware Exterior Static Display
- Expanded Gate 11 Entrance Facilities



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